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A new surgical technique to facilitate osteochondral autograft transfer in osteochondral defects of the capitellum: a case report

Kerem BİLSEL,[*] Mehmet DEMİRHAN,[#] Ata Can ATALAR,[#] Semih AKKAYA[†]

[*]*Department of Orthopedics and Traumatology, Gerede State Hospital, Bolu;*
[#]*Department of Orthopedics and Traumatology, Medicine Faculty of İstanbul University, İstanbul;*
[†]*Department of Orthopedics and Traumatology, Medicine Faculty of Pamukkale University, Denizli*

A 17-year-old boy who was engaged in amateur weightlifting and body building presented with complaints of right elbow pain and limitation in elbow range of motion. Plain x-rays and magnetic resonance imaging showed an osteochondral defect in the medial third of the capitellum. At surgery, as a new technique, the lateral collateral ligament was detached from the humeral attachment to provide access to the capitellum with a clear and perpendicular exposure. Following removal of loose fragments within the joint, an osteochondral graft harvested from the lateral femoral condyle was implanted to the defect area of the capitellum. Postoperative radiologic controls showed that the defect was entirely filled by the graft with appropriate graft height. On follow-up examination at 12 months, the patient did not have any complaint about his elbow, and had no limitation of movement compared to the left elbow. Magnetic resonance imaging showed that the graft was successfully adapted to the recipient site without any sign of loosening. At final follow-up 40 months after surgery, the surface of the articular cartilage appeared normal. The range of elbow motion was preserved and the patient had no restriction in daily and sports activities. Considering technical difficulties posed by the narrow and complex structure of the elbow joint, this new technique involving detachment of the lateral collateral ligament facilitates perpendicular implantation of the graft. In our opinion, utilization of this new technique will improve functional and radiological results of osteochondral autograft transfer.

Key words: Bone transplantation/methods; elbow joint/injuries/surgery; osteochondritis dissecans/surgery; transplantation, autologous.

Osteochondral defects of the capitellum are a well-defined pathology in adolescent throwing athletes.[1] The mechanism of these defects has not been thoroughly clarified, but repetitive microtrauma resulting from extreme valgus stress during throwing activities has been proposed to play a prominent role.[1]

Excision of chondral defects and revascularization of the defect area by subchondral abrasion or drilling have been reported as an effective treatment.[2-4] Osteochondral autograft transfer is advocated for large and unstable osteochondral defects to achieve a long-term success in elbow function and to obtain a normal hyalin cartilage.[5,6]

Several surgical treatment modalities have been defined for osteochondral defects of the elbow.[7] Long-term clinical results of fragment excision, which is considered a minimal invasive procedure, have been found dissatisfying.[8] Fixation of the osteochondral fragment combined with bone grafting may be an alternative surgical option.[9] However, the success of this technique decreases in large and unstable osteochondral lesions. Recently, surgical methods such

Correspondence: Kerem Bilsel, MD. Gerede Devlet Hastanesi, Ortopedi ve Travmatoloji Birimi, 14900 Gerede, Bolu, Turkey.
Tel: +90 374 - 311 20 24 e-mail: kbilsel@yahoo.com

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Fig. 1. Preoperative **(a)** anteroposterior and **(b)** lateral radiographs showing an osteochondral defect of the capitellum. Magnetic resonance scans of the osteochondral defect: **(c)** low signal intensity on the T1-weighted image and **(d)** high signal intensity on the T2-weighted image.

as osteochondral autograft transfer[5] and autologous chondrocyte transplantation[10] have been reported to yield good short-term results in severe chondral defects. Closing wedge osteotomy of the lateral condyle which reduces the load on the lesion has also been proposed as an optional surgical treatment.[11]

We report on a patient in whom osteochondritis dissecans of the elbow was treated by osteochondral autograft transfer which was accomplished after separation of the lateral collateral ligament at its humeral insertion.

Case report

A 17-year-old high school boy who was engaged in amateur weightlifting and body building presented with a complaint of right elbow pain of about four-year history. He did not define a major trauma and the pain recently showed a progressive increase in severity causing limitations in elbow range of motion.

On physical examination, flexion and extension of the right elbow were measured as 5°-5°-120°, hyperextension was painful, and there was tenderness on the radiohumeral joint on palpation. Varus and valgus stress tests showed no sign of instability and there was no limitation of pronation and supination of the elbow.

Plain x-rays and magnetic resonance imaging (MRI) showed an osteochondral defect in the medial third of the capitellum, with low signal intensity on T1-weighted images and high signal intensity on T2-weighted images. According to the MRI classification of Dipaola et al.,[12] the appearance was consistent with a type III lesion, with chondral fibrillation and high-intensity edema beyond the fragment (Fig. 1).

Surgery was performed under general anesthesia, in the supine position, with tourniquet application, and through a posterolateral incision of the elbow. The lateral collateral ligament was reached through the anconeus and extensor carpi ulnaris muscles and was detached from the humeral attachment with a bony insert and marked with sutures. Elevation of the lateral collateral ligament provided access to the capitellum with a clear and perpendicular vision. Then, the capsule was opened and the radiohumeral joint was exposed. Loose fragments within the joint were removed. (Fig. 2a). Thus, the osteochondral defect in the capitellum was exposed in a perpendicular position when the forearm was placed in traction, with the elbow flexed to about 60 degrees in varus position (Fig. 2b). The osteochondral autograft transfer system (Allograft OATS, Arthrex, Naples, Florida, USA) was used for osteochondral autograft transfer. First, the size of the osteochondral defect was measured (Fig. 2c). The contralateral knee region was determined as the donor area. An osteochondral graft with a diameter and depth of 10 mm was harvested from the non-weight bearing region of the lateral femoral condyle and was implanted press fit to the defect area of the capitellum. It was observed that the graft completely filled the defect area with stable fixation (Fig. 2f). The congruity of the articular surface conformed well to the anatomy of the capitellum. Afterwards, the humeroradial and humeroulnar bands of the lateral collateral ligament were re-attached to their isometric insertion points

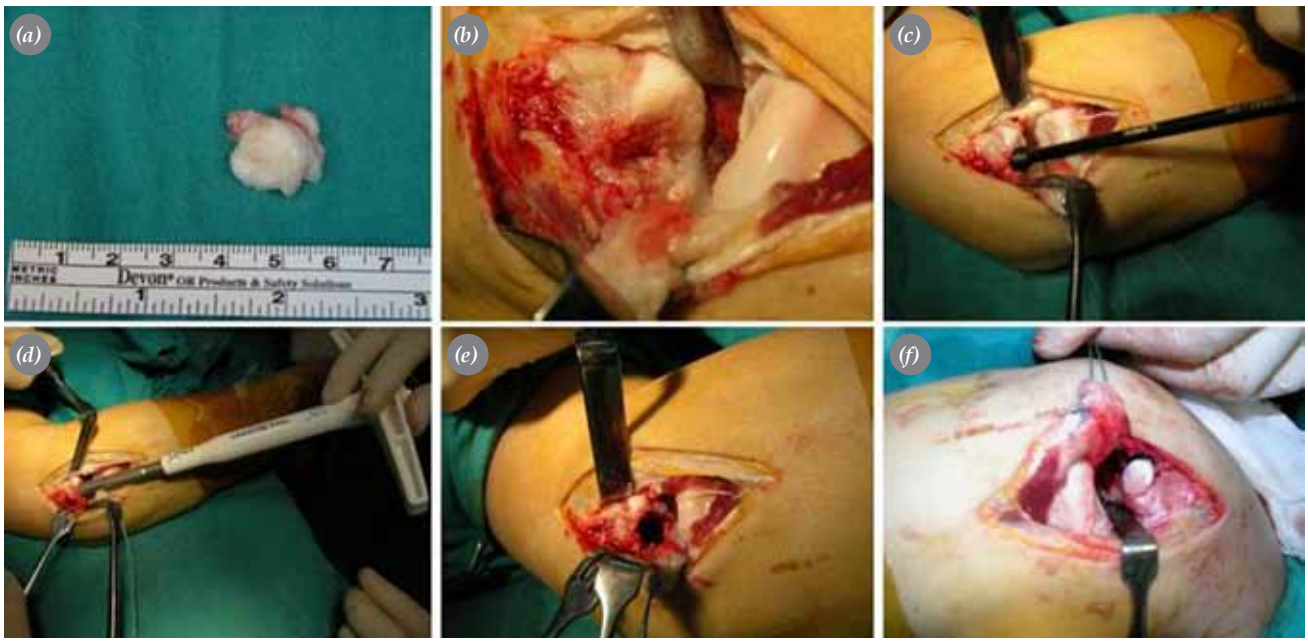

Fig. 2. **(a)** Excised capitellar osteochondral fragment. **(b)** The appearance of the capitellum after excision. **(c)** Measurement of the defect size. **(d)** Perpendicular access to the capitellum and removal of the defective area. **(e)** Preparation of the capitellum for osteochondral autograft transfer. **(f)** The appearance of the capitellum after press-fit fixation of the autograft obtained from the lateral femoral condyle.

with the help of two separate tunnels using No. 2 Ethibond sutures.[13]

Postoperative radiologic controls with plain radiography and MRI showed that the defect was entirely filled by the osteochondral graft with appropriate graft height (Fig. 3a-d).

Postoperatively, a long arm splint was applied keeping the elbow at 90 degrees flexion and the forearm in pronation. On the second postoperative day, a long arm, angle-adjustable brace was applied that prevented varus load to the elbow and kept the forearm in pronation. Upon regression of edema, controlled active-assistive range-of-motion exercises were initiated. The long arm, angle-adjustable brace was applied for four weeks, after which active range-of-motion exercises were started. Elbow and forearm strengthening exercises were allowed in the third month and sports activities were allowed after the sixth postoperative month.

On follow-up examination at 12 months, the patient did not have any complaint about his elbow. Range of motion measurements of the elbow joint were as follows: extension-flexion 0°- 0°- 140°, pronation-supination 85°- 0°- 90°. Compared to the left elbow, there was no limitation of movement. Stress tests showed no mediolateral and posterolateral instability. Magnetic resonance imaging showed that the graft was successfully adapted to the recipient site without any sign of loosening (Fig. 3e, f).

At final follow-up 40 months after surgery, the surface of the articular cartilage and the bone underneath appeared normal (Fig. 3g, h). The range of elbow motion was preserved and the patient had no restriction in daily and sports activities (Fig. 4). The DASH (Disabilities of the Arm, Shoulder and Hand) score which was 12 preoperatively decreased to a score of 1 in 12- and 40-month follow-ups.

Discussion

Osteochondritis dissecans of the capitellum generally occurs in throwing athletes and weightlifters due to repetitive loading of the elbow. Its diagnosis is mainly based on direct X-ray and MRI examinations.[1]

Conservative treatment of 24 patients with capitellar osteochondral defects resulted in limited improvement and poor functional outcome.[14] Arthroscopic surgery which consists of removal of the loose body or chondral fragment, abrasion chondroplasty, or drilling of the subchondral bone provides optimum pain relief in the short term.[2-4]

Fig. 3. **(a)** Anteroposterior and **(b)** lateral radiographs and **(c)** sagittal and **(d)** axial magnetic resonance scans obtained on the first postoperative day. Magnetic resonance **(e)** sagittal and **(f)** coronal sections of the elbow joint at 12-month follow-up. **(g)** Anteroposterior and **(h)** lateral radiographs obtained at 40 months.

Valgus osteotomy performed to decrease compressive forces on the capitellum increases bone remodeling and revascularization. Lateral closing wedge osteotomy performed in seven baseball players resulted in complete pain relief and return to preinjury sports activities in six patients.[11]

Osteochondral autograft transfer has been defined as one of the surgical options in repair of end-stage osteochondral lesions of the knee and ankle joints, severely unstable detachment of chondral surfaces, and full-thickness defects.[15,16]

Nakagawa et al.[5] reported that a baseball player who underwent combined surgery of osteochondral autograft transfer and closing wedge osteotomy for osteochondritis dissecans of the capitellum returned to preinjury sports activity in the fifth postoperative month and had radiographically good results during a 35-month follow-up. In another study, cylindrical osteochondral bone plugs were implanted to the defect area in 10 patients with capitellar osteochondral lesions, and excellent clinical and radiographic results were achieved in eight patients during a follow-up period of 18 to 45 months.[17] Yamamoto et al.[6] reported that 15 of 18 baseball players returned to their previous sports performance levels following osteochondral autograft transfer for osteochondritis dissecans of the elbow. In a case presentation of three nonthrowing athletes, it was suggested that osteochondral autograft transplantation be a surgical

Fig. 4. Clinical results at final follow-up 40 months after surgery.

option in nonthrowing athletes with end-stage osteochondritis dissecans of the capitellum.[18] Iwasaki et al.[19] obtained excellent or good results in 87% of patients (7/8) treated with mosaicplasty. The authors claimed that mosaic-like implantation of grafts provided better compatibility with the articular surface of the capitellum compared to a single monoblock graft.[19] Takahara et al.[20] assessed 106 patients with osteochondritis dissecans of the capitellum at the end of a mean follow-up of 7.2 years. The authors classified the lesions as stable and unstable and observed that stable lesions with an open capitellar physis and a good range of elbow motion responded well to conservative treatment, while unstable large lesions with a closed capitellar physis and restriction of elbow motion were better treated with fragment fixation or reconstruction of the articular surface than with simple excision.[20]

The technique of osteochondral autograft transfer for the elbow is more demanding than that for the knee. Several surgical techniques have been defined for the anatomic restoration of the radiocapitellar joint. Because of the difficulties of osteochondral graft implantation perpendicular to the articular surface, oblique osteochondral graft transplantation has been recommended for large defects and for those involving the lateral aspect of the capitellum.[21]

Current surgical treatment options for unstable osteochondritis dissecans of the capitellum include fragment excision and articular surface reconstruction.[22] Fragment excision can be accomplished arthroscopically or by an open posterolateral oblique approach. The latter involves a 4 to 6 cm posterolateral oblique incision which provides access to the posterior aspect of the radioulnar joint after passing thorough the posterior edge of the lateral epicondyle and the intermuscular plane between the anconeus and extensor carpi ulnaris muscles. A minimal synovectomy may contribute to enhanced exposure. Arthroscopy may be required for proximal part of the capitellar lesion. Reconstruction of the articular surface is performed with osteochondral autografts harvested from the posterolateral surface of the olecranon or from the lateral femoral condyle surface of the patellofemoral joint. Both harvesting and implantation of the graft at a direction perpendicular to the donor and recipient surfaces, respectively, are of particular importance for articular adaptation of the graft to the defect area. Avoidance of causing injury to the growth plate in patients with an open capitellar physis, obtaining a step-off of less than 1 mm following reconstruction of the articular surface, and filling at least 70% of the capitellar defect are emphasized as the most important surgical considerations to improve the results.[22]

Considering current controversies in the management of osteochondritis dissecans of the capitellum, we aimed to demonstrate a new surgical technique for osteochondral autograft transfer in order to overcome technical difficulties posed by the narrow and complex structure of the elbow joint and to present our long-term clinical and radiological results. This new technique involves detachment of the lateral collateral ligament from its humeral insertion, thereby facilitating perpendicular implantation of the graft, and resembles malleolar osteotomy performed in ankle pathologies. In the presented case, anatomical repair resulted in complete and uneventful recovery of the collateral ligament. In our opinion, utilization of this new technique will improve functional and radiological results of osteochondral autograft transfer.

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